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ABSTRACT

This report is a review of the Joint Integrated Contingency Model (JICM), which is a large modelling and simulation tool for campaign analysis at the theatre and operational levels. The JICM has been evaluated with special emphasis on its suitability for application in support of the Australian Defence Force. The core of this report is a user's manual, which can serve as a concise guide to new JICM users. It also contains insights gained by the authors into the operation of the JICM. The suitability and limitations of the JICM for campaign analysis in support of the Australian Defence Force are discussed.

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Executive Summary

The Theatre Operations Branch has evaluated the Joint Integrated Contingency Model (JICM) developed by the RAND Corporation. This was done as part of the DSTO Campaign Model Development Task (LRR 99/202) to identify and evaluate modelling and simulation tools suitable for theatre-level campaign analysis in support of the Australian Defence Force.

The JICM is a fast modelling and simulation tool for campaign analysis at the theatre and operational levels. It is designed to operate on the Sun UNIX (Solaris) operational platform, and it can be operated and supported by a couple of analysts. However, the full potential of the JICM can be more readily realised with the support of seminar war games using teams of military operational experts.

The JICM was designed for campaigns at levels found in the European theatre and the Korean peninsula, though it has been applied to more limited conflicts in recent years. Its suitability for analysing conflicts at the scale likely to be encountered by the Australian Defence Force (ADF) has been the central issue of this evaluation. The limited scope for modelling C4ISR and logistics impose restrictions on its applications for the ADF.

The main part of our evaluation was the application of the JICM to support the Australian Army's Headline Experiment and the Army Experimental Framework campaign concept development in 2001. This work has since been extended to support the Defence Experimental Framework (DEF) Pilot Study in 2002. The value and potentials of the JICM for supporting the ADF in longer terms are still being assessed.

In addition to addressing the issues mentioned above, this report will serve as a concise user's manual. This should prove particularly useful for new JICM users, as it can be difficult to digest the JICM documentation provided by RAND in a short space of time.

Contents

1. Introduction

1.1 Background

The Joint Integrated Contingency Model (JICM) is a large modelling and simulation (M&S) tool, developed by the RAND Corporation under the sponsorship of the US Office of the Secretary for Defence (OSD), for campaign analysis at the strategic and operational levels of land, air and maritime warfare, with emphasis on the theatre level of operations. It was first developed in the 1980s with large-scale combats in the European theatre and the Korean peninsula in mind. As the model matured, both the scale and nature of military threat changed with the end of the Cold War. While the JICM has been used to study full-scale wars such as confrontations between the Koreas and between Indian and Pakistan, the JICM is being increasingly used in the US to analyse military conflicts of a more limited nature, including several studies on regional conflicts in Eastern European countries and between China and Taiwan across the Taiwan Strait.

Approval for RAND to provide the JICM to DSTO was granted by OSD in 1999. RAND provided initial training to DSTO and updated JICM to meet certain DSTO requirements in 2000. Due to a change in staff responsibilities, one of the authors (MFL) took over the responsibility for evaluation and adaptation of the JICM for the Australian Defence Force. As will be discussed later in this report, a number of technical issues had to be addressed in order to meet our force size and structure, and strategic requirements. At the initial stage of our evaluation, we were severely hampered by the lack of coherently written documentation. In many instances, hours were spent on locating relevant information from within the JICM documentation. Furthermore, the war or operational plans, which contain the concept of operations (CONOPS) and tactics, in a JICM campaign scenario play a crucial role in linking all the central elements of the campaign together. In other words, the analyst must possess some basic knowledge of military planning and be able to play the role of a "commander" when setting up these plans. Our experience has shown that the quickest and best way of arriving at a set of realistic operations plans for a JICM scenario is by seminar war-gaming with military personnel playing the Red and Blue teams.

Once a general version of the Australian order of battle (ORBAT) and relevant regional information had been assembled into the JICM database, and a couple of scenarios based on the Australian Indicative Planning Scenarios (AIPS) were constructed, it became a relatively straightforward matter for an experienced JICM analyst to create new scenarios for the ADF reasonably quickly (in the order of 2-3 staff-weeks). However, keeping the JICM database current and the technical expertise readily available remain a challenge in maintaining the JICM in DSTO.

The JICM was first used in support of the Army Experimental Framework campaign concept development in 2001, and its value and suitability are being further evaluated in the Defence Experimental Framework Pilot Study in 2002. One of the main reasons for using the JICM is that it enables us to quickly explore a large number of campaign options within a general campaign concept. It is also the only campaign model currently available that can be run by a single analyst with a relatively short turnaround time. These applications are part of an ongoing evaluation and modification process.

A couple of comments should be made about the verification and validation of the JICM. First, RAND had conducted verification and validation of the JICM (RAND Publication No. PM-323-NA) long before we acquired it. As external JICM users, we are in no position to verify models developed by RAND and instead should trust the rigours of their verification process. On the subject of validation of a campaign model, the very concept itself is highly problematic to say the least. As pointed out in the RAND document, validation of military operations models is difficult because of the lack of a firm scientific basis for comparison. Unlike technical, and even tactical, models such as one describing the firing of missiles at an aircraft, no two battles are the same and therefore there is no controllable and objective basis, or the so-called "real world", for us to compare our models with.

It cannot be emphasised more strongly that the JICM is a tool for exploratory analysis, and *not a wargame* for predicting whether a certain battle would favour a particular side or not. Instead, it is best considered as a sophisticated calculator for helping analysts to evaluate their perception of a campaign.

1.2 General Features

The JICM has been designed to operate on the Sun UNIX (Solaris) platform, though effort is currently underway in RAND to convert the JICM to operate on PC-based Linux. The simulation can be run entirely in closed loop form and is capable of very fast execution (approximately 1 day/minute). Alternatively, the JICM can be run interactively with the analyst assessing the development of the campaign over every 4-hour (simulation time) period. For example, the analyst can activate contingency plans, change tactics, choose different weapon loads for bombers, and change troop deployments.

The JICM was designed to evaluate a wide range of case studies using many different parameters within a single scenario concept for comparative analysis. In the JICM, all aspects of a joint military campaign are dealt with in an integral and self-consistent manner. This means that the central element in setting up a new campaign on the JICM, scripting the operational (war) plans, must be done in a manner consistent with the concept of operations and should be thoroughly checked before the scenario is used for analysis.

The JICM contains four main components: the simulation component and its software, the database, the scenarios and the models. The models in the JICM describe force functionality such as lift and mobility, air combat, land war, maritime operations, and logistics. By changing appropriate parameters, analysts can, to an extent, script their own models or alter existing ones to suit their requirements.

The JICM is a deterministic model with a 4-hour time step ("delta"), subdivided as necessary into "sub-deltas" by the discrete event implementation of Situational Force Scoring (SFS); certain single-platform maritime operations such as ASW also use a pseudo-stochastic decision making process. Computations, graphic displays and battle progress during a simulation are controlled by the *J*-language, an interface language for the analyst to interact with the JICM simulation. Commands can be given in an interactive fashion or scripted into war plans; this allows the analyst to script the behaviour of forces and control data values of JICM objects dynamically during a simulation. The analyst can also invoke contingency plans, either interactively or via the use of decision logic.

The JICM database is quite large, containing information about geography and choke points, terrain difficulty and sea conditions, weapon performance and human capability, C3I data and order of battle, command structure and much more. In the JICM database it is easy to set up a coalition command structure and coalition operations are no more difficult than those run by a single nation. Many of the parameters in the database can be modified or new ones added to suit the requirements of a particular country and scenario. However, the complexity of the database presents one great hurdle in the initial understanding and mastering of the JICM. It is a labour-intensive and ongoing process to keep the database up-to-date and well understood.

Air, land and sea operations are linked together via the war plans stored, by convention, in the **.plan* and **.cday* files. The sequence of events is then linked in the *daily* file(s) which calls up, amongst others, the **.plan* and **.cday* files. It is through the *J*-language, which permits decision logic to be implemented in the war plans and contingency plans invoked, that the air, land and sea operations become intertwined into joint operations. In scripting these plans, a sound knowledge of military campaign operations is highly desirable, if not mandatory.

The JICM has a relatively high level of aggregation. Land forces are played at division or brigade levels, though JICM has provision for defining new objects (aggregates) such as company or platoon in the JICM database. The sizes and capabilities of these objects may then be scaled relative to a US division, though care should be taken in using the SFS parameters to make sure that the combating forces are scaled proportionately and that the attrition rates on both sides make sense.

Units of air force are defined at squadron level but air tasking orders can draw aircraft from different squadrons of the same wing. The number of aircraft per

squadron can be varied without affecting the combat attrition calculations since air combats are calculated on a one-to-one engagement basis.

The naval model operates with individual platforms.

1.3 JICM operations

The JICM contains three main modelling components that govern the operations of the three armed services: air operations, ground combat, and naval and amphibious operations. Each component contains its own models, mode of operation and relevant database, as well as sharing parts of the JICM database such as geography, command structure, and government attitudes. The overall combat is then integrated into a single, joint campaign plan via the **.plans*, **.cday* and *daily.*Z* files; these contain the operational details as well as some combat tactics.

Ground combat is the most developed component of the JICM. Troops are moved on a network of links. There is a reasonable degree of manoeuvrability, and combat is carried out in a flexible manner such that flank attack and encirclement are allowed. Positions can also be overrun. Speed of troop movement depends on the type of terrain. Combat attrition is measured in a number of ways including effective (US) division and equivalent effective division.

The air operations part of the JICM is well developed and similar to THUNDER in structure and doctrine but the degree of detail contained in these two packages differ. All US air missions can be conducted in the JICM, although maritime patrol by aircraft is considered part of the naval operation. Air tasking orders are determined according to US doctrine. Attack helicopters can be played either as part of the army weaponry (long-range artillery) or as an air unit governed by air missions and air tasking orders.

The naval and amphibious operations component is not a generic JICM product *per se*, but rather a US Navy model embedded in the JICM. Consequently, the JICM has significantly less control over the naval models and their functions. On the other hand, basic maritime operations such as embarkation of troops, amphibious landing and antisubmarine warfare can be implemented in a straightforward manner. Effects like ship detection and evasion are treated in a pseudo-stochastic manner due to the single platform nature of the naval ships.

1.4 The war plans

As mentioned above, the scenario and its associated war plans play the central role in linking together the air, land and sea operations. The JICM requires the analyst to write out the entire operational plans for both sides (including coalition partners) in a combat. These plans must contain details such as names of commands and the forces assigned to them, deployment place and time, air tasking orders, bombing and air combat strategies, maritime patrol area, troop movement and manoeuvring,

deployment, positioning and defensive posture, and lift of materiel. The timing and sequence of execution of these plans and the coordination of movement of different armed forces together form the overall joint campaign.

The process of scripting the war plans is usually iterative. One first drafts the basic plans and then runs some simulations to check if everything makes sense. For example, is the timing of a sequence of operations correct? Is a surface ship without antisubmarine warfare capability being sent to a sea area before the threat of enemy submarines has been eliminated? The analyst makes appropriate corrections and adjustments until everything is correct. After ensuring that the war plans and the sequence of events all make good sense, one is in a position to start conducting campaign analyses. As mentioned above, the best course of action for setting up a reasonable set of war plans may be to follow an iterative process of using military experts in a seminar war-game in order to generate the initial set of operational plans; these plans can then be implemented in the JICM and the results analysed. If necessary, experts can be further consulted and the plans improved or altered.

1.5 Outline of this report

In the following chapters, we will give a concise guide outlining the essential steps and relevant technical details in order to set up the JICM and create a scenario from scratch. It should be pointed out that it is not the aim of this report to be *the* comprehensive JICM user's manual. On the contrary, all of the other documentation issued by RAND is necessary to give the fine detail missing in this outline. New JICM users are encouraged to use this report together with all the relevant JICM manuals. What new JICM users may find most useful in this report are the lessons learned and some of the idiosyncratic features that cannot be found in the JICM manuals provided by RAND. A summary of the report will be given in Section 8.

2. Running the JICM (version 4.0β)

2.1 System requirements

At present, we run the JICM on a Sun Ultra 5 with the Solaris 8 operating system, since this is the only platform that can run the associated (but unsupported) map/graph system. However, RAND is currently working on implementing JICM on PCs running on Linux. Once this work is complete, RAND will no longer support the JICM on Solaris.

The minimum Workstation requirement is a Sun Sparc station with Solaris 2.5 (or later) operating system. RAND recommend the use of Suns with at least 16 MB of main memory and at least 600 MB of disk space for a standalone system.

2.2 Quick start

2.2.1 Setting up the workspace

The tutorial contains detailed instructions for initially installing the JICM from 8mm magnetic tape. After this installation is complete, users need to establish a personal workspace for doing analysis. The procedure (taken from the tutorial) is as follows:

Log on and locate yourself in the directory under which you wish your JICM workspace located:

```
cd ~james
```

Decide on the name you want the top directory of your workspace to have (we picked *Tut* in this example), move or remove any pre-existing directory of that name, then type in the following to create the workspace:

```
~cjones/Master/U/make_work
mv Work Tut
```

Note that the script *make_work* may need to be hacked to account for the possibility that the user directories are not located at the default location.

Now that the directory structure has been created, you will need to select a specific 'case'. The case specifies which files from the World Situation Data Set (WSDS) will be compiled into the input database. The default case name is specified as a link from the top directory. If we want to run the example scenario distributed with the JICM, we want to select case a00 in the following way:

```
cd ~james/Tut
rm default
ln -s wsds.a00 default
```

After selecting the case, both the *D* and *Plan* directories need to be populated with appropriate data files. The *D* directory should currently contain links to the default data files used to create the input database, while the *Plan* directory should be empty. Eventually, the analyst's own files will populate these two directories. However, to run the example scenario, all we need to do is run the input processor

```
cd ~james/Tut/D
input
```

and link the example plan files to the *Plan* directory

```
cd ~james/Tut/Plan
ln -s ../Master/ALL/ROK/* .
```

2.2.2 Running the JICM (for beginners)

The JICM can be started on its own by typing

```
cd ~james/Tut
jicm
```

or it can be started with the map/graph system by typing

```
cd ~james/Tut
startup
```

The tutorial introduces basic commands that can be input at the command line, and is a good introduction to the JICM. Appendix C of the tutorial addresses the map/graph system comprehensively.

2.3 Useful inputs to the JICM

COMMAND	ABBREV	DESCRIPTION
advance	a	Advances the JICM simulation by a period of time
display	d	Accesses JICM data about the scenario
order	o	Allows the analyst to change the war plans
set		Sets JICM parameters
log	lo	Changes the log level
pause		Pauses the execution of JICM war plans until the **resume** command is entered
resume	re	Cancels a **pause** command
quit	q	Exits the JICM if used twice
doccer		Accesses online documentation
map		Tells the map when to update

Instead of typing in the whole command, the analyst may type in the abbreviation listed.

2.3.1 advance

Follow the `advance` command by the amount of time required.

```
advance 4
```

will advance the scenario by 4 hours, while

```
advance d2
```

will advance the scenario by 2 days.

2.3.2 display

The `display` command gives the analyst information about what is happening in the simulation at the current time. As such, it is one of the most important ways to verify that a simulation is running according to the wishes of the analyst.

To use it, simply follow the `display` command by the required display name. Simply typing in the command will give an incomplete list of displays available. For some displays, capitalising the display option causes the JICM to output more information. An almost complete list of possible displays is given in the JICM display documentation. Additional displays are documented in presentations detailing updates to the JICM. An overview of JICM displays is also given in Appendix G of the JICM tutorial.

2.3.3 order

The `order` command changes the war plans for the scenario. The analyst can use this command to try off-the-cuff changes to the war plans. However, it is probably better to do "what-if" analysis in a more systematic way, through specific tailored war plans in

separate files. There is a brief introduction to the use of orders in Appendix H of the JICM tutorial.

2.3.4 Set

The `set` command changes JICM parameters. However, most of these affect the simulation environment and should not be changed after initialisation.

2.3.5 log

The `log` command followed by an appropriate number changes the log level to be displayed at the user interface. However, it may be better to set parameters like **UNIT→log_level** and **COMMAND→log_level** to appropriate values. Higher log levels (like 10 or 20) give more information than a moderate log level (like 3 or 5), although the extra output may prove to be excessive.

2.3.6 pause and resume

The `pause` command is used to temporarily interrupt the processing of a war plans file, which allows the analyst to change parameters, issue additional orders and extract data at that point in time. The `resume` command causes the JICM to continue processing the war plans file from the place it was interrupted.

2.3.7 quit

To quit the JICM, the analyst should type the command `quit` twice (i.e. `quit quit`), since only typing it in once leads to a confirmation prompt.

2.3.8 doccer

The use of the command `doccer` is described in the chapter below called "Support Documentation".

2.3.9 map

Once the map/graph system has been started, the `map` command is used to specify when the map is updated.

```
map now
```

updates the map immediately, while

```
map 24
```

updates the map every 24 hours.

3. Setting up the scenario

3.1 Top-level directory

The top-level directory contains a number of directories, some of which will be described below. In addition, it contains the executables *jicm* and *startup* as mentioned previously. There should also be *default*, which defines the case that the input processor will compile, and *path*, which should define the search path for JICM files. Lastly, the file *doccer* is an executable that allows the analyst to view documentation on orders, parameters and displays available. We will discuss *doccer* again in the section on documentation.

3.2 Input database (D directory)

This directory contains WSDS files that describe the world geography, force structure, force elements, weapons, and other miscellaneous information that defines the environment in which the JICM will run scenarios. The input processor compiles appropriate files (as selected by case) to allow the JICM to load this data more quickly.

The following table briefly describes the key files found in the (unclassified) *D* directory. Most of these files `#include` other files, which are also listed.

TITLE	CONTENTS	INCLUDES
RANDabase.unc	Air base data (DO NOT CHANGE)	
RANDtgt.unc	Target type data (DO NOT CHANGE)	
air.unc	Air force types, initial placement of the air force (including individual unit definitions), and allocation of aircraft to aircraft carriers.	aftypes.*.unc, air.*.unc, navair.unc, navair.*.unc
airbase.unc	Air base parameters, locations and type	airbase.*.unc
command.unc	Command details	command.*.unc
geog.unc	All geographic and government data	
ground.unc	Ground force types and initial placement of the ground force (including individual unit definitions)	ground.*.unc
kv.unc	Killer-victim scoreboard (DO NOT CHANGE)	kv.*.unc
maritime.unc	Sea routes and sea boxes	
materiel.unc	War reserve materiel and maritime prepositioned sets	materiel.*.unc
misc.unc	Scenario date, general JICM parameters, and aliases for JICM regions	latlon.*.unc
missile.unc	Individual missile names and definitions, placement of missile forces	missile.*.unc
mobility.unc	Sealift vessel capability, sealift forces available for use (but not amphibious or pre-positioned ships), airlift routes, airlift aircraft capability, airlift forces available for use, loading data for airlift and seaports	sealift.unc, sealift.*.unc, airpipes.*.unc, airlift.unc airlift.*.unc,
place.unc	JICM places, route groups, land locked regions, and link existence and length	links.neur.unc
sfs.unc	Situational force scoring (DO NOT CHANGE)	sfs.*.unc
target.unc	Types of weapons storage sites, sea ports, naval bases, ground force bases and other miscellaneous facilities	
vessel.unc	Description of vessel types, combat data, initial placement of the naval	vessel.*.unc

	forces (including individual vessel names and definitions), effect of sea region on combat, anti-air warfare data	
weapon.unc	Description of munition classes (missiles, torpedoes)	nukes.rsas.unc, chems.rsas.unc

Data can be added directly to these files if necessary, but it may be a better idea to `#include` scenario specific files. For example, we might add the file *air.james.unc* to the *D* directory to contain all the changes that we wanted to make to the air part of the database. In addition, we would edit the file *air.unc*, adding

```
#include air.james.unc
```

in the appropriate place – in this case, this would be just before the line

```
end of Air Forces Table input data
```

since we want our files to overwrite any conflicting data in the other files.

The next table is a quick reference designed for use when adding information to the database. It should help the reader to identify files that may need to be altered. Scenario specific files are specified below by using "my" in the file name. For information on capitalised files, see the later section on the *JMODS* directory.

INFORMATION	FILES
Geographical information	MY.GEOG geog.unc place.unc
Facilities	facility.unc
Ground troops - Type and munitions	geog.unc missile.unc
Ground troops - Allocation	command.unc
Ground troops – Positioning, movement and orientation	MY.EVAC facility.unc geog.unc ground.unc missile.unc mobility.unc
Ground troops - Orders	my*.cday my*.plans
Aircraft - Type and munitions	air.unc
Aircraft - Allocation	command.unc
Aircraft – Positioning and movement	MY.GEOG.AIR air.unc airbase.unc mobility.unc
Aircraft - Orders	ato.my.* my*.cday my*.plans
Naval - Type and munitions	vessel.unc
Naval - Allocation	command.unc
Naval – Positioning and movement	facility.unc maritime.unc materiel.unc mobility.unc vessel.unc
Naval - Orders	my*.cday my*.plans

The following sections will outline the most common additions and changes to be made to files in the *D* directory. In general, the in-file documentation has all the information necessary to alter the files correctly.

3.2.1 air.unc

Custom planes, air units and naval air units can be defined here. Each air unit definition shows the following information: unit name, role conversions, location, ownership, type, number of aircraft, alertness, readiness, command, destination, and air base class.

3.2.2 airbase.unc

Extra air base types and new air bases can be scripted into this file.

3.2.3 command.unc

This file contains all data concerned with default command structure. Custom command structures to fit the scenario will need to be added. Each definition shows the following information: command name, superior, location, participants, and command type. Note that the analyst will generally allocate force elements to commands in the *Plan/*.cday* files.

3.2.4 geog.unc

This file contains most of the geographical and political information that the JICM uses to describe the physical environment. Attitudes between governments, permissions set by a government, and aggregates can be changed in this file. Cities and land networks are defined in *place.unc*.

3.2.5 ground.unc

All of the ground forces to be used by the analyst should be added here. Each entry contains the following information: unit name, default position, owner, force type (size), and number of personnel and weapons. Note that ground-based SAM units are included here, and must be incorporated into a ground force.

3.2.6 maritime.unc

Sea routes and sea boxes are defined in this file. The analyst is unlikely to need to change possible sea routes, since all shipping can be explicitly routed from source to destination. However, the analyst is likely to need to create new sea boxes to define patrol areas of maritime patrol aircraft and submarines, as well as to allow the correct aggregation of queried output data.

3.2.7 materiel.unc

Extra stockpiles or pre-positioned sets can be added if required.

3.2.8 misc.unc

Many miscellaneous things are defined in this file, most of which are best left alone. However, new aliases for JICM regions can be added if desired.

3.2.9 missile.unc

New missile types and prepositioned missile forces can be added to this file.

3.2.10 mobility.unc

This file contains data required for the lift models in the JICM. New sealift and airlift types and forces can be added to this file.

3.2.11 place.unc

This file contains the data defining the ground network used by the JICM. New places and links can be added if desired. In addition, places can be nominated as ports, allowing the maritime and lift models to use this place to unload personnel and equipment. Terrain is defined in the *Plan* directory - *REROK.GEOG* (in the *JMODS* directory) shows an example of how this is done.

Note that links are not allowed to cross each other. Instead, the analyst can add an intermediate central place and then add appropriate links through it.

3.2.12 target.unc

Generic regional targets that will not be explicitly detailed can be added to this file. The analyst will target these when air strikes and air interdiction are directed against the region. Similarly, SAMs can provide terminal defence for these targets if they are directed to do so.

3.2.13 vessel.unc

This file contains the data defining ships that the JICM will recognise. New ship types can be defined, and all required naval forces can be added.

3.2.14 weapon.unc

This file contains all of the different munitions that the JICM plays explicitly. Custom types can be added if desired.

3.3 Useful files from previous studies (JMODS directory)

The analyst is likely to use and alter a number of files from the JMODS directory because they contain scenario specific parameters. The following table lists the most commonly used files:

TITLE	CONTENTS	CHANGES
INITS	standard file used in every mission	
SOL.PATH	path used to search for JICM files	
STARTUP	start-up script for JICM and graphics package	
MY.PARAM	contains most game specific parameters	create scenario specific parameters
MY.GEOG	contains terrain information on all links to be used, and adds aliases for locations and paths	create region specific terrain, useful positions and paths
MY.GEOG.AIR	contains penetration routes from one place to a list of destinations	create region specific flight paths
MY.EVAC	evacuation orders	create a valid evacuation table

The JICM has many available parameters that can be altered. However, this can be both a blessing and a curse; the adaptability of the model is balanced by the invisible nature of the many default parameter settings that may be incompatible with the current scenario. Appendix A contains a list of parameters that were changed in *ROK.PARAM*, *ROK.GEOG* and *ROK.GEOG.AIR*, which the analyst can use as a template for *MY.PARAM*, *MY.GEOG* and *MY.GEOG.AIR*. There is also a list of other useful parameters. However, the analyst will eventually need to do a quick check of all JICM parameters.

Important documentation on individual parameters can either be found online through *doccer*, or in a file that can be found on the JICM website. The file *~cjones/Master/A/Doc/parm.tutorial* contains a list of parameters that the programmers recommend for review.

3.4 War plans (Plan directory)

The *Plan* directory contains files detailing the analyst's war plans. The JICM seeks the following files (taken from the tutorial):

- At start-up, it initially seeks the file *./set_up* (which is not normally used), followed by any file specified at the command line (again, this option is not normally used). Then, it attempts to run *Plan/USE*, which will normally provide start-up instructions and call other files to initialise the JICM database.
- Every four hours, the JICM seeks for an appropriate *daily.**00Z* file. Most commonly, the file *daily.0000Z* is used to provide instructions for the JICM to carry out at the daily game time 0000Z. However, additional instructions can be given at 0400Z, 0800Z, 1200Z, 1600Z and 2000Z by adding them to the corresponding *daily.**00Z* file.
- When the JICM notes the capture of a place, it seeks for the files *Plan/captured.N*, where N is the JICM name of the place, and *Plan/captured.place*. The first file (if

found) is implemented at the exact moment of capture, while the second (if found) is implemented at the end of the time step at which the capture occurred.

- When the JICM encounters (from the command line or in any Plan file being read) a `use` command, it demands the file named. All the rest of the JICM instructions are put into these files.

The following table shows standard files that may be found in the *Plan* directory. There are two columns titled 'use FILES' which list files that might normally be called from within the parent file; the first column has generic filenames, while the second has filenames from the example Korean scenario. Filenames all in uppercase (apart from *USE*) indicate that they originated from (and may still be found in) the *JMODS* directory.

TITLE	CONTENTS	use FILES (GENERIC)	use FILES (KOREAN)
USE	Contains JICM start-up script	INITS setup.analysis	INITS setup.analysis
daily.0000Z (there may also be daily war plans called at 4 hourly intervals after midnight)	JICM script to call daily war plans called at 0000Z, including Day 0 set-up plans and mobilisation plans (on E-day, C-day and D-day)	MY.GEOG MY.GEOG.AIR MY.PARAM ato.my.both myattacker.cday mydefender.cday myattacker.plans mydefender.plans	ROK.GEOG ROK.GEOG.AIR ROK.PARAM ato.rok skorea.cday nkorea.cday cfck.plans dprk.plans
ato.my.both	JICM script to include all appropriate air tasking orders	ato.my.attacker ato.my.defender	ato.red ato.blue
ato.my.attacker	Attacker's air tasking orders		
ato.my.defender	Defender's air tasking orders		
myattacker.cday	C-Day orders for attacker		
mydefender.cday	C-Day orders for defender		
myattacker.plans	Attacker's daily war plans		
mydefender.plans	Defender's daily war plans		
captured.place	Called when place is captured	MY.EVAC	ROK.EVAC.AIRBASES
setup.analysis	Set up/check selection values		
collect.init	Specify variables to be collected		
graphs.design	Define graphs displayed		

Note that RAND analysts use the terms C-day and D-day to mean the following:

- C-day is the day on which deployment starts
- D-day is the day on which hostilities commence

However, noting that each party to the conflict is most likely to start deploying troops on a different day, *setup.analysis* uses the term E-day to mean the attacker's C-day, while using C-day to mean the defender's C-day.

In the following sections, sections of the code in italic bold-type should be replaced with expressions or values appropriate to the scenario. In the next chapter (on Combat), we will deal with some parts of the war plans in more detail.

3.4.1 USE

The base file should look like this:

```
if $Today == $0
  define Warning = warning_time
  log out OFF
  use INITS
  use setup.analysis
  set force day "DDAY_PROMPT>"my_dday
  advance "d"my_dday
  log out ON
endif
```

Obviously, the warning time, prompt and automatic advance to D-day can be customised to suit requirements. Additional parameters can be added here if necessary.

3.4.2 setup.analysis

The base file should look like this:

```
define errors = 0

if ?vector["Warning,1,2,3,4,5,6,7] == False
  Msg ERROR:  vector["Warning,1,2,3,4,5,6,7] == False
  increment errors
else
  define my_eday = $eday
  define my_cday = $cday
  define my_dday = $my_cday+Warning
endif

if errors > 0
  ring
  Msg ERROR: JICM termination due to above USE selection errors.
  quit quit
endif
```

where `my_eday`, `my_cday`, and `my_dday` can all be varied as necessary. The definition of `Warning` is found in *USE*. Of course, the error check on *Warning* can be customised.

3.4.3 daily.**00Z

The base file should `use` all appropriate files when the appropriate game day is reached:

```
log out OFF
if $Today == $0
  use MY.GEOG
```

```
  use MY.GEOG.AIR
  use MY.PARAM
  use ato.my.both
endif

if $Today == $my_eday
  use myattacker.cday
endif

if $Today == $my_cday
  use mydefender.cday
endif

if $Today == $my_dday
  set itm CMD gnd_timing ...          (see p101, JICM parameter definitions)
    ...
  set helos CMD hel_timing ...        (see p104, JICM parameter definitions)
    ...
  set arty CMD art_timing ...         (see p105, JICM parameter definitions)
    ...

  set force his_init CMDs end

  order ATKCMD attack DEFCMD
  use myattacker.plans
  use mydefender.plans
  use collect.init                    (this allows the use of graphs)
elseif $Today > $my_dday
  use myattacker.plans
  use mydefender.plans
endif
log out ON
```

All additional parameter changes and war plans can be added to the appropriate day.

3.4.4 *.cday

These files should contain all orders necessary to deploy forces. Note that the various parties involved in the conflict are likely to deploy forces on different days, and thus will be called from *setup.analysis* on a different C-day. The following base file includes items that the analyst will commonly specify, with comments preceded by an asterisk. The orders and parameters in this file are discussed in more detail in the next chapter.

```
order GOV control CMD
order GOV unassign all - CMD

* Ground forces

order GOV assign UNIT CMD
  ...

set command orient CMD REVERSE(REAR)PATH(CONL)
```

```
  ...                                          (see p38, JICM parameter definitions)
set command tail_set CMD LENGTH
  ...                                          (see p38, JICM parameter definitions)

order CMD cmdmission ...
  ...                                          (see p12-3, JICM order definitions)
order UNIT gndmission ...
  ...                                          (see p13-6, JICM order definitions)

order GOV mobilize troops - - 100%   (see p16-7, JICM order definitions)
order CMD deploy troops - GOV - 100% - -
                                               (see p19-25, JICM order definitions)

* Air and missile forces

order GOV assign FORCE_TYPE LAND_REG PERCENT CMD
                                               (see p6-7, JICM order definitions)

order GOV alert air - - - 100%
order GOV alert missile - - - 100%   (see p17-8, JICM order definitions)
```

3.4.5 *.plans

These files should include all orders issued after the commencement of hostilities (on D-day). Standard requirements are:

- attacks by ground troops
- air sorties
- missile strikes

Note that orders to defend and dig in should already have been issued in **.cday*. See the next chapter for a more detailed discussion of these orders and parameters.

```
* Ground orders
order CMD cmdmission *
  ...                                          (see p12-3, JICM order definitions)

* Air sorties
set airwar CMD *_hitech HITECH_PERCENT
  ...                                          (see p82, JICM parameter definitions)

set airwar CMD sort_mult MULT DURATION
                                               (see p83, JICM parameter definitions)

set airwar CMD multi_ag PERCENT      (see p81, JICM parameter definitions)

order CMD apport air_gnd ...
order CMD apport air_air ...         (see p37-8, JICM order definitions)

order CMD alloc MISSION_TYPE TARGETS end
  ...                                          (see p 38-9, JICM order definitions)

set airwar CMD *_timing ...
```

```
  ...                                          (see p84-5, JICM parameter definitions)

set landwar CMD *_target TARGET
  ...                                          (see p46, JICM parameter definitions)

* SAMs and other anti-aircraft defence
order CMD gndmission alloc UNIT MISSION PERCENT ... MISSION PERCENT end
                                               (see p13-6, JICM order definitions)

* Missile strikes
set supply WPN_TYPE LOCATION OWNER MUNITION QTY
  ...                                          (see p59, JICM parameter definitions)
order GOV/CMD mslstrike MSL_NAME TYPE QTY TGT
  ...                                          (see p36-7, JICM order definitions)
```

Other useful parameters may be **LANDWAR→surprise** and **LANDWAR→chemical** (see p 47, JICM order definitions).

3.4.6 ato.my.both

For historical reasons, the analyst needs to include a file that calls all other *ato.** files. It should look like this:

```
define PkgNum = $1
use ato.my.attacker
define PkgNum = $2
use ato.my.defender
```

Any additional packages can be added after this in the obvious way.

3.4.7 Other ato.* files

These files contain information that the JICM requires to create air tasking orders. The base file should look like this:

```
if PkgNum != defined
  Msg ERROR: Define PkgNum = X (1 <= X <= 20) to use this Module
else
  set force ato_pkgs $PkgNum

  set force ato_pkgs mission pkg_no role sortie_no aircraft_type
      ...

  set force ato_pkgs end
```

where the definition list will generally contain several packages.

See also Chapter 7, JICM Air Operations Manual.

3.4.8 captured.place

As mentioned previously, the JICM seeks this file whenever any place is captured. The base file should look like this:

```
if ?region["PlaceCaptured] == ?region[region]
  define CapturedPlace = "PlaceCaptured
  use MY.EVAC
endif
```

If one wants to destroy enemy logistics and materiel, add this line:

```
script supply overrun "PlaceCaptured
```

Note that any location-specific contingency plans can either be scripted into this file or directly into a file *captured.N*, where *N* is the JICM place name.

The file *MY.EVAC* should be modelled on a file like *JMODS/ROK.EVAC.AIRBASES*, which contains an evacuation table and the logic necessary to process it.

3.4.9 collect.init

This file specifies all of the data that will be collected during the game run. The data can be accessed directly through JICM commands. In addition, the data can be used to create graphs through the *graphs.design* script. The base file looks like this:

```
collect startdate+ frequency (multiples of 4-hour)

collect collect_type var_name conditions end
  ...

collect end
```

where the list defines all the variables collected during the JICM run. Note that only 499 variables may be collected. Further documentation on possible collectibles can be found in the JICM display documentation.

3.4.10 graphs.design

This file defines the graphs that will be drawn on the Graph display. The file supplied with the initial distribution can be used as a template.

3.5 Log files (O directory)

During a JICM run, various output files are generated in the *O* directory.

3.5.1 ,log.*

The log file contains everything that transpired in the JICM window during the run. It may also contain orders and additional displays requested by the analyst. The file *~james/Tut/Doc/Other/readlog* gives some suggestions for using the log file to debug a scenario.

3.5.2 ,com.*

This file contains a history of commands entered at the command-line prompt.

3.5.3 ,evt.*

This is a data file associated with the naval model.

3.5.4 ,graphs.data*

This is the data file produced by the JICM for use by the Graph package.

4. Combat

In this section, we will assume that appropriate data populates the *D* and *JMODS* directories, and that we are now at the stage of writing war plans. Each of the following summaries is designed as a brief introduction for beginners and an aide-memoire for more experienced users. More detail can be found in the key references listed.

4.1 Ground combat

4.1.1 Key references

- Ground Combat in the JICM
- JICM order definitions

4.1.2 Data assumed to populate the input database

- Land network of places and links, with terrain
- Government attitudes and permissions
- Ground units - equipment strength, default location
- Command structure
- Evacuation orders

4.1.3 Assign units to commands

In **.cday*, it is standard practice to unassign all units from their default allocations, and then reassign units to commands:

```
order GOV control CMD
order GOV unassign all - CMD
order GOV assign UNIT CMD
```

Each ground unit must be assigned to a command before it can take orders.

4.1.4 Orient mobile ground force commands

After units are allocated to commands, those mobile (non-theatre) ground force commands with NO subordinate commands must be oriented on the ground network:

```
set command orient CMD REVERSE(REAR)PATH(CONL)
```

These commands must be oriented before they are eligible for `cmdmission` orders and ground combat.

4.1.5 Mobilise and deploy

Troops are mobilised and deployed in the following way:

```
order GOV mobilize troops - - 100%
order CMD deploy troops - GOV - 100% - -
```

This is normally done on C-day.

4.1.6 Order missions

Missions may be ordered in the following two ways:

```
order CMD cmdmission ...
order UNIT gndmission ...
```

Missions that can be specified in this way include attacking, defending, digging in (positional), and support or strike missions from helicopters or artillery.

Note that the position of commands issued `cmdmission` orders appear on the map when commands are displayed. However, individual units issued `gndmission` orders are not displayed separately. This means that the analyst should be wary of being too reliant on using the map to verify that a ground campaign is entered correctly.

4.1.7 Other things to consider

- Will helos and long-range artillery be used? If so, see "Ground Combat in the JICM", Chapter 4.
- Do land combat defences need to be built? If so, use
  ```
  set landwar CMD bld_barrier ...
  ```
- Are there minefields present? To create or alter them, use
  ```
  set itm minefield POSITION TYPE DENSITY
  ```
- Have logistics been considered? If not, see the chapter on logistics. Also, check to see that the following are set correctly:

```
set landwar CMD max_int_days DAYS
set landwar CMD resup_int DAYS
```

4.2 Air-to-air and air-to-ground engagements

This section contains the key steps needed for automatic air tasking order (ATO) generation. The JICM also allows the analyst to use the `airstrike` and `airmission` orders to create ATOs manually, but we will not discuss these orders here. The Air Operation Manual is probably the best written of all JICM manuals and readers are referred to it for details. Here we will provide only a brief summary.

Air-to-air combat occurs when penetrating and defending aircraft packages come into the same region. Attrition is calculated according to missile types, ranges, pk values and detection capability of each side. The presence of an AWACS, for example, will enhance the side's detection and interception abilities.

One particularly interesting feature in air-to-ground combat is the way moving ground units are attacked in the BAI and CAS missions. As each mission covers only a finite area, once the ground units move out of the mission range bombing will stop. To ensure that units will be attacked continuously as they move along the network of roads, one must allocate 50% CAS and 50% BAI in an attack mission. The JICM will then automatically decide which mission is appropriate and the bombing will occur continuously. See also the Air Operations Manual, Chapter 7, p29.

The percentage of multi-role aircraft allocated for air-to-air versus air-to-ground use has to be carefully specified. Failure to do so may result in no sorties flown. The readers are again referred to the JICM Air Operations Manual for a detailed description.

One important issue in air-to-ground combat is the engagement between ground-based air defence and attacking aircraft. For a more detailed discussion, see Section 4.3 below.

4.2.1 Key references

- JICM Air Operations Manual
- JICM order definitions

4.2.2 Data assumed to populate the input database

- Land network of places and links
- Flight paths, source and target regions
- Government attitudes and permissions
- Generic facilities
- Explicit facilities, including airbases and ports
- Air units - number and type of aircraft

- Command structure
- Air tasking orders
- Explicit loadouts if desired

4.2.3 Assign units to commands

Assuming that units have already been unassigned (in the Ground combat section), we now need to assign them to commands. This can be done in the same way as ground units:

```
order GOV assign UNIT CMD
```

4.2.4 Apportion sorties

We need to specify the percentage of air-to-ground and air-to-air sorties to be employed on the various missions:

```
order CMD apport air_gnd ...
order CMD apport air_air ...
```

4.2.5 Allocate mission packages

After generating missions, we need to specify how mission packages will be targeted:

```
order CMD alloc MISSION_TYPE TARGETS end
```

4.2.6 Specify timing of sorties

For each type of mission that will be flown, the JICM requires guidance on when packages will be flown:

```
set airwar CMD *_timing ...
```

where * may be replaced by `cas, bai, ai, sead, dca, sweep, oca, awacs` or `jstars`.

4.2.7 Other things to consider

If the analyst chooses to use explicit munition loadouts, it is often a good idea to also specify the percentage of packages that use high-tech (hitech) munitions:

```
set airwar CMD *_hitech HITECH_PERCENT
```

where * may be replaced by `cas, bai, ai, sead, oca,` or `other`.

To account for temporary effects, including surges and weather, a sortie multiplier may be useful:

```
set airwar CMD sort_mult MULT DURATION
```

The analyst may wish to specify the proportion of multirole aircraft that will fly air-to-ground missions:

```
set airwar CMD multi_ag PERCENT
```

If the analyst wants more control over targeting, one may specify the target for CAS or BAI missions supporting a specific command:

```
set landwar CMD *_target TARGET
```

where * may be replaced by `cas` or `bai`.

4.3 Ground-based air defence

JICM's ground-based air defence (GBAD) should strictly speaking be explained as part of the ground combat as GBAD units are allocated to defend either ground troops or valuable assets such as ports and airfields. However, much of how a GBAD works depends on the nature of enemy air missions, and hence the discussion in this section.

In the JICM modelling process, no distinction is made between anti-air artillery and SAMs, though only the term SAM units are used. It is entirely possible to use a SAM unit to represent anti-air artillery. GBAD units can be deployed in the same way as ground troops. They can be deployed to defend regions, cities, airbases, oriented commands and vessels. Note that SAM units are no longer part of the missile units defined in the JICM. Ground-based missiles in JICM mean surface-to-surface missiles including ICBM.

In JICM's Air Operations Manual, Chapter 9, there is a clear description of how to model air defence. The most crucial thing about making air-versus-ground-defence combat work is to ensure the compatibility of air mission and air defence types. For example, in order to attack GBAD units effectively, one should launch SEAD and not an AI mission. Indeed, if GBAD units are defending an airbase and an AI mission is conducted to attack the airbase, no GBAD units will be damaged but attacking aircraft will be shot down. Even if an AI mission were assigned to attack GBAD units, the efficiency would be much lower than would have been achieved using SEAD. It is also important to note that when a GBAD has been assigned to defend a region, the SEAD mission should also be assigned accordingly. Likewise, if GBAD is assigned to defend a city, the SEAD mission must also be launched against the same city.

4.4 Sea battle

In this section, we will assume that our task groups do not need to change their structure - to change task group structure requires the use of `assign` and `unassign`, the first of which we will only use to allocate task groups to commands.

Note that the naval part of the JICM seems to be rather idiosyncratic. Since it was not initially designed for the JICM framework, it is much harder for the JICM to interact with the naval model via JICM's *J*-language. Documentation for the naval model is highly rudimentary and, to complicate the matter further, it seems that as the JICM was being modified and improved over the years, the naval model was left behind with little attention paid to its compatibility with the rest of JICM. Therefore, it is suggested that JICM users model naval events with a great deal of care.

4.4.1 Key references

- JICM Naval and Amphibious Operations
- *Doc/Other/naval.forces*
- JICM order definitions

4.4.2 Data assumed to populate the input database

- Sea boxes, ports
- Government attitudes and permissions
- Task groups - ship details, default location, subordinate task groups
- Command structure

4.4.3 Assign task groups to commands

Again, we will assume that all task groups have been unassigned (in the Ground combat section). In the same way as ground and air forces, we assign task groups to commands:

```
order GOV assign TASKGROUP CMD
```

4.4.4 Move ships to required location or order a patrol

We can move ships from one place to another by using the `route` command. If we specify a ship that is not a flagship, we move only that ship. However, if we specify a flagship, we can choose to move it alone, or it with its task group by pre-pending it with an appropriate number of sharps (#).

```
order CMD route SHIPS ...
```

Similarly, we can order ships or a task group to patrol a region consisting of multiple sea boxes:

```
order CMD patrol SHIP SEAREGION SEABOX PERCENT ... SEABOX PERCENT end
```

Both of these orders are used to determine whether detections of one ship by another will occur.

4.4.5 Give standing orders

The naval model treats JICM `engage` orders differently to other types of orders, because it treats them as standing orders, active until cancelled or replaced by another order. The `engage` order allows us to tell ships what movement strategy they will follow (ignore, evade, trail or attack) when they detect other ships:

```
order CMD engage SUBJECT LOCATION VERB ATTITUDE TARGET PRIORITY
```

For engagements between surface forces, `engage` orders control engagements but do not initiate actual attacks automatically. A `seastrike` order (see next section) is required to begin attacks between these forces. However, if a submarine is involved and the standing orders permit an attack, antisubmarine warfare will occur automatically - no `seastrike` order is required.

4.4.6 Order individual sea strikes

Ships with strike capability can launch sea strikes against other ships and generic land targets (although this doesn't seem to work against air or sea bases):

```
order GOV seastrike SHIP WEAPON QTY TARGET
```

Note that torpedoes are solely reserved for battles including submarines, and CANNOT be targeted with a `seastrike` order.

4.4.7 Other things to consider

- To lay mines, the analyst simply scripts them into existence:
  ```
  set choke mine_lay CHOKE TECH_LEVEL BLUE/RED QTY
  ```
  while the clearing of mines occurs automatically when mine countermeasures are deployed:
  ```
  set choke mcm_deploy CHOKE BLUE/RED QTY
  ```
- Use of canals and choke point regions (Suez Canal, Panama Canal, Bosporus/Turkish Straits) - see "Lift and Movement in the JICM"

4.5 Amphibious landings

4.5.1 Key references

- JICM Naval and Amphibious Operations
- *Doc/Other/amphib*
- JICM order definitions

4.5.2 Data assumed to populate the input database

- Sea boxes, ports
- Government attitudes and permissions
- Ground units - equipment strength, default location
- Task groups - ship details, default location, subordinate task groups
- Command structure

4.5.3 Establish beaches

Beaches are non-port areas at which a combat landing is to occur. We can create them (associated with a place) in the following manner:

```
set beach PLACE create
set beach PLACE position POSITION
set beach PLACE length LENGTH
set beach PLACE width WIDTH
set beach PLACE quality QUALITY
```

Note that every beach must be associated with a place already existing in the land network. The position of the beach must be on a link, allowing enemy forces to oppose the landing.

4.5.4 Embark troops onto amphibious task force

Troops need to be embarked onto vessels before they can be moved to another location to attempt an amphibious landing. The `embark` order deploys both the ground unit and the task group to the specified port, and then embarks the troops onto the vessels:

```
order GOV embark UNIT FLAGSHIP PORT -
```

Instead of the final dash, the name of a contingency plan can be included, which will be automatically invoked when embarkation is completed.

Note that a separate task group is required for each amphibious unit, so it may be necessary to subdivide (or combine, if extra amphibious lift capacity is required) existing task groups.

4.5.5 Move ship to appropriate location

This is the same as in the sea battle section:

```
order GOV route SHIPS ...
```

If this movement is to immediately follow an embarkation, it can be triggered at the appropriate time in the following way:

```
when UNIT embarked order GOV route SHIPS ...
```

If the troops are to land at a beach, the ships should be directed to the place initially associated with the beach.

4.5.6 Land troops

There are two types of landings: a combat landing occurs at a beach, while an administrative landing occurs at a friendly port. Depending on the type of landing, the order will either be:

```
order CMD land FLAGSHIP combat BEACH GROUND_CMD
```

or

```
order CMD land FLAGSHIP admin PORT
```

Note that after a beach landing, the unit will join the specified ground command, allowing it to take part in ground combat.

4.5.7 Other things to consider

- Is the landing opposed? If so, check that enemy forces are situated somewhere 'on the beach'. The beach is considered to be adjacent to the portion of the land link that is centred at the position given for the beach, and of length equal to the width of the beach. Once enemy forces are in this area, the JICM will automatically carry out an opposed landing.

4.6 Air-to-sea interactions

Apart from maritime patrol aircraft (MPA), there are no air-to-sea interactions for land-based aircraft. The JICM assumes that aircraft carriers are always available and therefore all maritime sorties should be conducted from carriers. The MPA mission is the only means in the JICM to conduct a search for a ship and then attack it in the same mission.

4.6.1 Key references

- JICM Naval and Amphibious Operations
- JICM order definitions

4.6.2 Data assumed to populate the input database

- Sea boxes, ports
- Government attitudes and permissions
- Task groups - ship details, default location, subordinate task groups
- Command structure

4.6.3 Maritime patrol aircraft

In the JICM MPA are used entirely for anti-submarine warfare (ASW) and the modelling process seems to work well, though careful consideration must be given to the detection parameters. For ASW, the search and attack mission can be issued as follows:

```
order CMD patrol MPA-SQUADRON - AREA PERCENT
...
order CMD engage MPA LOCATION ATTITUDE TARGET PRIORITY
```

While in principle, it should be possible to use MPA against surface ships, we have not been able to make this work. Since we are supposed to be among the few experts (RAND not being one of them, apparently) of using the naval model, we have little recourse but to conclude that it is not possible to attack surface ships using MPA.

4.6.4 Aircraft carriers

We have so far failed to get planes to strike at ships, partly because we cannot give them anti-ship loads. From the manual, incorporating MPA onto an aircraft carrier does not actually cause ASW missions to be flown - instead, it simply enhances the carrier's ASW effectiveness.

4.6.5 Anti-air warfare

It seems that launching an interdiction mission against a ship does not trigger any of the ship's air-defence capability, which would imply that the strike is not actually

being launched. Once again, this is an example of the lack of full compatibility between the naval model and the rest of the JICM.

5. Logistics

In general, logistics is one of those elements of a campaign that is neglected until the analyst tries to do something that somehow involves it. Maybe we want to launch an air strike, but then realise that our aircraft are not correctly loaded with munitions. Maybe we realise that the logistic tail for a ground command is 150 kilometres long, and that would be unrealistic for this scenario. Maybe we are asked to see what effect an extra two days of supply (for a ground unit) will have on the outcome of the campaign. Whatever the situation, it is not always easy to find out what the current arrangements are, and then it may not be easy to pinpoint the parameters that need to be changed. This is partly because the representation of logistics in the JICM is so implicitly embedded in the input database and the parameters.

Some useful ideas appear below, but this is not a comprehensive account of logistics in the JICM - treat it more as an agglomeration of some of the logistics issues that these authors came across.

5.1 Miscellaneous

- To give infinite ammunition of all types, use:
  ```
  set govt GOV script_ammo on
  ```
  Variants exist that give infinite ammunition of a certain type:
  ```
  set govt GOV script_gnd on
  set govt GOV script_hel on
  set govt GOV script_air on
  set govt GOV script_msl on
  set govt GOV script_sam on
  set govt GOV script_lra on
  set govt GOV script_ves on
  ```
- Stocks of munitions can be increased or decreased by using:
  ```
  set supply weapon_type LOCATION OWNER MUNITION AMOUNT
  ```
- To choose whether ammunition is stored in the unit's region or the theatre's region, use:
  ```
  set force ammo_source CHOICE
  ```
- To define packets of munitions for resupply, use:
  ```
  set supply packet ITEM QUANTITY ... ITEM QUANTITY end
  ```
- To move supplies, munitions and war reserve materiel from one region to another, use:
  ```
  order GOV resupply LIFT_CMD OWNER ORIG DEST MODE TYPE QTY
  ```
- Pre-positioned materiel is dealt with in the following documentation:
  - "Lift and Movement in the JICM", Chapter 7
  - "Ground Combat in the JICM", p75

- "JICM Naval and Amphibious Operations", p74.

To add war reserve materiel, use:

```
set supply wrm REGION OWNER CMD WEAPON QTY AV_EDS
```

5.2 Ground

The "Ground Combat in the JICM" manual deals with some issues to do with logistics in Chapter 9. These issues include:

- Rate of munition consumption

```
set materiel THEATRE supply_mult POSTURE MULT
set materiel THEATRE intense_mult MULT
```

- Resupply

```
set materiel THEATRE reorder_point AMOUNT
set materiel THEATRE supply_objective AMOUNT
set materiel THEATRE network_capacity AMOUNT
set materiel THEATRE gndforce_capacity AMOUNT
```

- Logistic tail considerations

```
set itm THEATRE tail_spd SPEED
set itm THEATRE tail_min SPEED
set itm THEATRE tail_atk SPEED
set itm THEATRE tail_hold SPEED
set landwar CMD tail_half LENGTH
```

In addition to these issues, the analyst may want to consider the following:

- To set the default number of days of supply for ground units, open *ground.unc* and edit the appropriate line starting with SUP. To set the amount of supply for a specific unit, open *ground.unc* and add an exception to the appropriate unit:

```
dos = AMOUNT
```

- To instantaneously supply ground troops with ammunition, use:

```
set ground supply OWNER COMMAND AMOUNT
```

- To script delivery or destruction of ground munitions in a region, use:

```
set supply ammo_self REGION OWNER AMOUNT
set supply ammo_other REGION OWNER AMOUNT
```

5.3 Air

The "JICM Air Operations Manual" mentions different lift models to deploy logistics on p4, Chapter 6. However, it does not make clear why one model would be preferred over another.

5.4 Sea

- To set the number of AAW missiles initially loaded on ships, use:

```
set class CLASS aaw_msls_lr AMOUNT
set class CLASS aaw_msls_sr AMOUNT
```

- To set the current number of AAW missiles on a ship, use:

```
set vessel VESSEL aaw_msls_lr AMOUNT
set vessel VESSEL aaw_msls_sr AMOUNT
```

- To set the current number of torpedos on a ship, use:

```
set vessel VESSEL torpedos AMOUNT
```

6. Lift

Implementing lift in the JICM is a simple process:

- allocate lift assets to a command (which must have 'lift' specified somewhere in its type) containing the unit to be moved:
  `order GOV assign LIFT-TYPE PERCENT CMD`
- issue a `deploy` order:
  `order GOV deploy UNIT DEST MODE`

The JICM automatically allocates sealift and/or airlift as required. However, the analyst needs to check that sealift and airlift assets are available. Otherwise, the ground unit will simply wait at the sea/air port of embarkation without giving an error message. Thus, the difficult part of lift is in making sure that lift forces are available (i.e. created) and accessible (i.e. correctly assigned).

Lift forces are initially defined in *airlift.unc* and *sealift.unc*. Note that airlift is not located in a specific place, while sealift is located the same way that ships are located.

If the analyst does not want to deal explicitly with lift, the following commands can be used instead:

```
set force gnd_embark UNIT OWNER GROUP SPOE PLAN
set force ves_move VESSEL DEST DAY
set force air_move UNIT OWNER DEST DAY
```

For more detail, see "Lift and Movement in the JICM".

7. Support documentation

7.1 Manuals

Here is a list of the manuals that are available for the JICM:

1. 'JICM 3.5 tutorial', Daniel Fox, Carl Jones, 1999(?).
2. 'Ground combat in the JICM', Barry Wilson, Daniel Fox, 1995.
3. 'JICM Air Operations Manual', Barry Wilson, September 1998.
4. 'JICM Naval and Amphibious Operations - An Annotated Briefing for Users', Arthur Bullock, February 1994.
5. 'Theater Combat Operations', Barry Wilson, Daniel Fox, June 1995.
6. 'Lift and Movement in the JICM', Carl Jones, June 1994.
7. 'Situational Force Scoring (SFS) in the Joint Integrated Contingency Model (JICM)', Barry Wilson, Jeff Rothenberg, October 1999.

These manuals contain most of the information about running the JICM that the analyst may require. However, the content of these manuals sometimes turns out to be outdated due to the continuing development of the JICM. Generally, the documentation is supplemented with PowerPoint presentations that update the analyst on changes between versions.

7.2 Other references

RAND has produced several very useful lists related to the JICM:
1. JICM order definitions (also found at *~cjones/Master/A/Doc/orders.doc*)
2. JICM parameter definitions (also found at *~cjones/Master/A/Doc/parameter.doc*)
3. JICM display documentation (also found at *~cjones/Master/A/Display*)
4. J functions
5. JICM glossary

In addition, analysts at RAND produce presentations that detail updates to the JICM for user group meetings. These meetings are held a couple of times a year to address issues raised by JICM users.

7.3 'doccer' and online documentation

RAND distribute a considerable amount of online documentation with the JICM, which can be found in *~cjones/Master/A/Doc/*. Often, this documentation will be the most current (although not necessarily the most comprehensive) documentation available. While this documentation can be accessed through standard text editors, a lot of it is designed to be accessed through `doccer`, which is an executable that can either be run from the directory *~james/Tut*, or from inside the JICM. On running `doccer`, there should be a manual interface that prompts the user about what he/she wants to see, and leads him/her through the documentation.

7.4 The JICM website

The JICM website contains some of the documentation that has been written for the JICM. In addition, it may contain PowerPoint presentations detailing updates to the JICM in new releases. It is password protected to restrict access to JICM users only. Access details can be obtained from RAND.

8. Summary

From an Australian perspective, one of the most obvious limitations of JICM is the problem of scaling-down of force size. While the JICM permits non-US users to create their own ground objects and therefore in principle can handle Australian Army units such as brigades and companies, it should always be borne in mind that JICM ground combat has been calibrated at the combat intensity of division and corps level combats, and are averaged over several brigades. While one of the authors (MFL) has conducted many company-level combat simulations and has found that the troop attrition and advance rates make sense, JICM users are urged to carry out their own tests on the behaviour of any non-US, user-defined ground units.

The second limitation of the JICM is the use of land and sea regions, which can only be modified by RAND. This feature imposes severe restrictions on the use of fictitious land regions and governments, with the consequence that it may become extremely difficult to obtain technical assistance from JICM developers in RAND when the scenarios are classified. Resolution problems may also arise when a scenario involves a small piece of land, such as one of the Pacific island countries, being occupied by opposing forces. In such case, radar coverage and detection probability will become serious issues as the radar density in our regions is likely to be far sparser than that in the Northern Hemisphere. There are ways to overcome or to get around some of these problems, whereas others may be more intractable. Australian JICM users are urged to be aware of potential problems caused by the predefined land and sea regions when modelling combat, radar detection coverage, logistics and movements in our neighbouring regions.

The lack of interaction between air and sea in the JICM represents a major problem for Australian users. This is partly a result of the assumption in the JICM that aircraft carriers are always available, and partly due to the fact that the JICM naval model is not a JICM product *per se* with the consequence that the JICM does not have full control of many parameters in the naval model. Given Australia's geographical and strategic environments, this represents one of the most serious drawbacks of the JICM.

For some campaigns that are relatively simple and sequential in nature, where failure of one mission could imply failure of the entire campaign, the JICM may not be the best tool to use; instead, it may be better to study a series of missions, each modelled at higher fidelity than that is available in the JICM. In other words, we should always bear in mind that the JICM was designed for large-scale campaigns in the Northern Hemisphere, whereas we in Australia are more likely to deal with localised combats at mission level.

Despite the above-mentioned reservations, the JICM remains one of the few truly joint campaign models for analysis at the theatre and operations levels. Its deterministic nature makes it easy for quick comparative analysis, even for scenarios that require

higher fidelity in technical and tactical details and geographical resolution than the JICM can provide. Indeed, one way to help overcoming some of the shortcomings of the JICM as applied to Australian scenarios is to use high fidelity simulation models to calibrate some of the JICM input parameters, such as average detection rate by a small number of radars covering a wide area. It is also worth mentioning that the JICM is pretty good at keeping track of a range of ammunitions consumed. For example, if a submarine on a mission has fired all the torpedos it carries, it will returned to home base and re-stocks before going back on patrol again. Thus the JICM can, to some extent, be used for logistics purpose.

It is worth emphasising that the JICM is not a wargame for predicting which side will win a battle. Instead, it is best suited for identifying critical elements in a campaign. As stated in RAND's JICM documentation, the JICM is best viewed as a sophisticated calculator for evaluating the perceived outcome of a scenario, and for assessing the alternatives within the same general campaign concept. The JICM is ideal for making a large number of parametric excursions from a baseline scenario in order to gain insight into the campaign concept and to hedge against uncertainty.

Finally, the JICM should be considered an important and integral part of a tool set for operational synthesis, in which a number of tools are used to analyse different aspects of a campaign; the results are then combined to provide a (hopefully) more complete and accurate picture than any one of these tools alone could give. Just as in the application of any and every modelling and simulation tool, it is paramount to understand the limitations of the tool and apply it within the scope that it was designed for. With this in mind, the JICM can prove to be a powerful modelling and simulation analysis tool for campaign concept development and analysis in support of the Australian Defence Force.

Appendix A: JICM parameters

A.1. Parameters defined in *ROK.PARAM*

PARAMETER	QUICK DESCRIPTION	page no
LANDWAR→tng_min	%training needed before deploy	54-5
LANDWAR→armor_min_fwd	Min no of armoured vehicles at front at max advance rate	55
LANDWAR→infty_min_fwd	Min no of infantry weapons at front at max advance rate	55
LANDWAR→arty_min_fwd	Min no of artillery at front at max advance rate	55
ITM→armor_per_km	Armoured vehicles/km that can fight	101
ITM→infty_per_km	Infantry weapons/km that can fight	101
ITM→arty_per_km	Artillery/km that can fight	101
LANDWAR→delay_density	Defender's SED/km density below which a breakthrough occurs while delaying	50
LANDWAR→brk_loss	One-time %attrition to defender suffering a breakthrough	54
LANDWAR→attk_main	Force ratio required for a main attack or counterattack	49
LANDWAR→attk_spt	Force ratio required for a supporting attack	49
LANDWAR→attk_pin	Force ratio required for a pinning attack	49
LANDWAR→attk_replace	%cohesion when attacking unit is replaced by reserve unit	52
LANDWAR→attk_pull	%cohesion when attacking unit is pulled from front	52
MATERIEL→days_recover	No of days for ground force to recover 10% of lost cohesion	88
LANDWAR→arty_trap_pct	%separate artillery of positional force that transfers to forward manoeuvre force when manoeuvre force overrun at forward battle	54
LANDWAR→arty_escape_pct	%manoeuvre artillery of positional force that transfers to separate artillery when manoeuvre force overrun at forward battle	54
ITM→mine_kills	Fraction of vehicles/infantry killed by minefield, density 1	102-3
LANDWAR→keep_up_mult	Mult: ability of arty to keep up with rapid advances	50
ITM→tail_hold	Max length of logistics tail before front must stop attacking/advancing	102
ITM→tail_half		??
ITM→tail_atk	Max length of logistics tail to launch new attack	102
ITM→tail_spd	Max speed of logistics tail (km/day)	102
ITM→tail_min	Min length of logistics tail (km)	102
ITM→max_length	Max length of command's orientation (km)	101
LANDWAR→arty_range_kms		54
ITM→armor_req_mult	Mult of SED density of armor needed to prevent shortage	99
ITM→inf_req_mult	Mult of SED density of infantry needed to prevent shortage	99
HELOS→score_req	If zero, use HELOS→hel_criteria to rank targets, not as an absolute requirement	104
ARTY→score_req	If zero, use ARTY→art_criteria to rank targets, not as an absolute requirement	105
HELOS→hel_range	Max one-way range of this command's attack helicopters	103
HELOS→flot_dist	Max kms forward of a supported command front that helos seek targets if no in-contact targets available (does not supersede BAI range)	103-4
CMDGOV→gnd_mult	Ground combat effectiveness mult for command or gov	42
GOVT→airair_mult	Final multiplier of air-to-air effectiveness	34
GOVT→airgnd_mult	Final multiplier of air-to-ground effectiveness	34
CMDGOV→helo_mult	Helo effectiveness multiplier for command or government	42
AIRWAR→pkg_set	Select the package set used to create the ATO	87
AIRWAR→bai_fwd_kms	Defines size of BAI forward zone (from MOFL)	85
AIRWAR→bai_bck_kms	Defines size: BAI back zone (from MOFL + bai_fwd_kms)	85-6
AIRWAR→bai_fwd_move	Relative weight of moving ground force in the forward BAI zone as used during target selection	86
AIRWAR→bai_frontal	Zero if forces in frontal contact with supported command not to be included as BAI targets	86
AIRWAR→self_esc_int	No of self-escorting mission aircraft that will drop air-to-ground loads to engage each attacking DCA aircraft	87

ITM→vehicle_kills	Kill multiplier of enemy vehicles by target posture	96
ITM→arty_kills	Kill multiplier of enemy artillery by target posture	97
ITM→terrain_mults	Kill multiplier of enemy veh/art/troops by target terrain	96
ITM→infty_allocs	%infantry weapons targets	97
ITM→infty_kills	Kill multiplier of enemy infantry by target posture	97
ITM→vehicle_wgts	Relative value of a vehicle as used during target selection	97-8
ITM→arty_wgts	Relative value of artillery as used during target selection	98-9
ITM→infty_wgts	Relative value of infantry as used during target selection	98
ITM→ed_delay_hrs	Delay from 1 sortie/volley of attack per ED of moving target	99
REGION→sort_mult	Final multiplier of tacair (fighter, defender, cas, bomber, multi) sorties	41
REGION→refugees	100%: max slowing because of refugee prob, 0%: no prob	40
LOC→max_speed	Max movement speed on line of communication (km/day)	37
LOC→min_speed	Min movement speed on line of communication (km/day)	37
MATERIEL→local_repair	Fraction of total losses instantly repairable by local support	89
FORCE→mob_tank_frac	Fraction of US air-refuelable airlift supported by tankers	13
MOBILITY→css_rorofrac	Fraction of CSS units that must sealift on RoRo ships	73
MOBILITY→us_delay	Delay (hrs) after surface move before a US ground force is fully ready	74
MOBILITY→gnd_delay	Delay (hrs) after surface move before non-US ground force is fully ready	74
MOBILITY→air_delay	Delay (hrs) after airlift before ground force is fully ready	74
MOBILITY→sea_delay	Delay (hrs) after sealift before ground force is fully ready	74
MOBILITY→mps_delay	Delay (hrs) after MPS unload before ground force is fully ready	74
MOBILITY→berths	No of berths at named seaport	73
GOVT→af_css_pct	%multiplier of size of a government's air force squadrons	32

A.2. Some other useful parameters to include in *MY.PARAM*

PARAMETER	QUICK DESCRIPTION	page no
FORCE→loadouts	Define optional aircraft loading sets	6
FORCE→gnd_move	Beam ground force to a new position	7
FORCE→gnd_embark	Beam ground force aboard naval group (with amphibious ships)	8
FORCE→ves_move	Beam ship to new ship location	8
FORCE→air_move	Beam air force to new location	8-9
FORCE→msl_move	Beam missile force to new location	9
FORCE→aggr_list	Create, change or delete aggregate list of regions	9
FORCE→date	Set the calendar date (note possible conflict with misc.unc)	9
FORCE→day	Set the reference day (see /Plan/USE for an example)	9
UNIT→pct_cap	%carrier air unit assigned to CAP	29
GOVT→gf_size_pct	%multiplier of size of a government's land combat units	31
GOVT→gf_css_pct	%multiplier of size of a government's army CSS units	32
GOVT→air_lift_pct	%multiplier of size of a government's airlift fleet	32
GOVT→sea_lift_pct	%multiplier of size of a government's sealift fleet	32
GOVT→pomcus_pct	%multiplier of size of a government's POMCUS set	32
GOVT→prepo_pct	%multiplier of size of a government's afloat prepo sets	32
GOVT→navy_mult	%multiplier of combat effectiveness of a govt's naval forces	34
GOVT→ecm_mult	%multiplier of ECM effectiveness for a country	34
GOVT→sort_mult	%multiplier of tactical sorties for a country	36
GOVT→tng_rate	Rate of increase of training readiness	36
REGION→loc_mult	Multiplier of overland movement rates	41
REGION→airlft_loss	Frac attrition of all airlift delivering into land region during war	41
REGION→mob_mult	Final multiplier of mobilisation speed	41
CMDGOV→armor_mult	Armor effectiveness multiplier for a command or government	42
CMDGOV→infty_mult	Infantry effectiveness multiplier for a command or government	42
CMDGOV→arty_mult	Artillery effectiveness multiplier for a command or government	42
CMDGOV→adef_mult	Air defence effectiveness multiplier for a command or govt	42
CMDGOV→comb_mult	Combined effectiveness multiplier for a command or government	42
CMDGOV→air_gnd_mult	Joint air-ground operations effectiveness mult for command/govt	42-3
CMDGOV→home_mult	Effectiveness multiplier when fighting on home territory	43

CMDGOV→cntr_battry	Counter-battery fire effectiveness multiplier for command/govt	43
CMDGOV→cntr_manvr	Counter-manoeuvre fire effectiveness mult for command/govt	43
CMDGOV→deep_fires	LR arty effectiveness multiplier for a command or government	43
LANDWAR→load_set	Select a FORCE→loadouts set for a ground command's helos	43-4
AIRWAR→load_set	Select a FORCE→loadouts set for air commands	83
MATERIEL→supply_mult	Analyst multiplier of all theatre supply consumption	90
ITM→att_mult	Multiplier of attrition from manoeuvre combat	99
ITM→vel_mult	Multiplier of FLOT movement rate	99

A.3. Parameters defined in *ROK.GEOG*

PARAMETER	QUICK DESCRIPTION	page no
LOC→path	Establish pre-defined paths across networks	36
LOC→location	Establish pre-defined positions on networks	36
LOC→max_speed	Maximum allowable movement speed on link	37
LANDWAR→terrain	Terrain data on network link	44-5
LANDWAR→bld_barrier	Place land combat defences or order them to be built	45
MATERIEL→prep_left	Total sq kms of prepared defences that a theatre can build	88
MATERIEL→fort_left	Total sq kms of fortified defences that a theatre can build	88
ITM→minefield	Create minefields	103
ITM→add region	Adds region to a theatre's list of regions	91

A.4. Parameters defined in *ROK.GEOG.AIR*

PARAMETER	QUICK DESCRIPTION	page no
AIRWAR→fly_from_regs	List of regions from which squadrons can participate in air war	80
AIRWAR→tgt_into_regs	List of regions that can be attacked by packages in ATO	80
AIRWAR→pen_routes	Penetration routes to each target region	80-1

Appendix B: Glossary

This glossary is taken from the JICM website.

TERM	DEFINITION
AAA	Anti-aircraft artillery
AAW	Anti-air warfare
ABAT	
Abel	Programming language developed by RAND
ABL	Airborne laser
ABM	Anti-ballistic missile
Abn	Airborne
AC, Acft	Aircraft
ACL	Allowable cabin load
ACM	Air launched cruise missile
ADA	Air-defense artillery
ADBN	Air-defense battalion
ADef	Air defense
AF	Air force
Afld	Airfield

AfldDef	Airfield defense
AI	Air interdiction
AirDef	Air defense
AKA	Also known as
ALCM	Air-launched cruise missile
Alt	Altitude
AMC	USAF Air Mobility Command
Ammo	Ammunition
Amphib	Amphibious
AMRAAM	Advanced medium-range air-to-air missile
AO	Area of operations
AOA	Amphibious objective area
APAM	Anti-personnel/anti-materiel
APC	Armored personnel carrier
APOD	Air port of debarkation
APOE	Air port of embarkation
AreaDef	Area defense
ARMD	Armored division
APED	Anti-platform equivalent division
Arm, Armd	Armored division
Arty	Artillery
ARV	Armored reconnaissance vehicle
AS	Air squadron
Asg	assigned
ASW	Antisubmarine warfare
ATACMS	Army tactical missile system
ATGM	Anti-tank guided missile
Atk-helo	Attack helicopter
ATO	Air tasking order
ATW	Anti-tank weapon
Avail	Available
Avg	Average
AW	Air wing
AWACS	Airborne warning and control system
BAI	Battlefield air interdiction
BAT, ABAT	Brilliant anti-armor technology submunition
BB	Break-bulk (ship)
Bde	Brigade
BM	Ballistic missile
Bmbr	Bomber
BMP	(Russian) infantry combat vehicle
Bn	Battalion
BRDM	(Russian) amphibious scout vehicle
Breakt	Breakthrough
C3	Command, control, and communications
C3I	Command, control, communications, and intelligence
CADEM	Calibrated differential equation methodology
CAIR	Civilian airfield
CAS	Close air support
Cbt	Combat
CBTZ	Combat zone (rear position)

C-day	Day on which deployment starts
CEur	Central Europe (command)
CFCK	Combined Forces Command, Korea
CFE	Conventional forces in Europe
Cgo	Cargo
Chem	Chemical
CINC, CinC	Commander in chief
CM	Cruise missile
Cmd	Command
Cntr	Counter
Commo	Communications
CONL	Control line
Cont	Continue, container (ship)
CONUS	Continental United States
Conv	Conventional
CRAF	Civil reserve air fleet
CSS	Combat service support
Cum	Cumulative
CV	Aircraft carrier
CZ	Panama canal zone
dash	the hyphen character "-"
DBX	Debugger (programming tool)
DCA	Defensive counter-air
D-day	Day on which hostilities commence (literally, Day-day)
Delta-t	JICM clock advance increment (4 hours)
Dest'n	Destination
Dist	Distance
Div	Division
DMZ	Demilitarized zone
DoS	Days of supply
DPRK	Democratic People's Republic of Korea
D-rate	Dispersal rate
DTG	Date/time group
ECM	Electronic counter-measures
ED	Equivalent division
EED	Effective equivalent division
EK	Expected kills
Eng	Engaged
Eqp	Equipment
Equiv, eq	Equivalent
ETE	expected time enroute
FAC	Forward air controller
Fbomber	Fighter-bomber
FLOT	Forward line of own troops (same as MOFL)
Force	JICM's simulation models (collectively)
Frac	Fraction
Fric	Friction
FSCL	Fire support coordination line
FSS	Fast sealift ship
Gded	Guided
GIGAP	Greenland/Iceland gap

GLCM	Ground-launched cruise missile
GMT	Greenwich mean time
Gnd	Ground
Gov, Govt	Government
G-type	Ground (force) type
HARM	High-speed anti-radiation missile
Helo, Hel	Helicopter, attack helicopter
HET	Heavy-equipment transporter
H-hour	Hour at which hostilities commence (literally, Hour-hour)
His, hist	History
Hitech	High technology
Hvy	Heavy
Hx	Helicopter
ICBM	Intercontinental ballistic missile
ID	Infantry division
IFV	Infantry fighting vehicle
Inf, Infty	Infantry
Init	Initial, initialization
INT[X]	greatest integer in the expression X
Intnsty	Intensity
IR	Infrared
ITM	Integrated theater model
ITV	Improved TOW vehicle
IUKGap	Iceland/UK Gap
JICM	Joint integrated contingency model
JSTARS	Joint surveillance and target attack radar system
K-Kill	Catastrophic kill
Km(s)	Kilometer(s)
KPax	1,000 passengers
KPD	Kilometers per day
KPH	Kilometers per hour
KSTon, KST	Kilo-short tons (1000s of tons)
KV	Killer-victim
Lant	Atlantic
LASH	Lighter aboard ship
Lat	latitude
lat/lon	Latitude/longitude
LAW	Light anti-tank weapon
LCAC	Landing craft air cushioned
Lgt, Lt	Light
Link	Two way arc connecting two JICM places
LMSR	Large, medium-speed RoRo
LoC	Line(s) of communication
Logfile	JICM output file of displays and messages
Lon	longitude
Lotech	Low technology
LR	Long-range
LRA or LR-Arty	Long-range artillery
MAGTF	Marine Air-Ground Task Force
MAIR	Military airfield
MAP	JICM's map graphics program

Max	Maximum
MBbl	1,000,000 barrels
Mbomber	Medium bomber
MCM	Mine counter-measure
M-day	Day on which mobililization starts
MDS	Mission designator series (for aircraft, e.g. A-10)
MEB	Marine expeditionary brigade
Mech	Mechanized
Med	Mediterranean
MEF	Marine expeditionary force
M+F+K	Mobility, firepower, and catastrophic (kills)
MIDAS	A mobility simulation model
Min	Minimum
misc.unc#number	A numbered parameter in the data file misc.unc
MLRS	Multiple-launch rocket system
Mnvr, Mnv	Maneuver
Mob	Mobilize(d)
MOE	Measure of effectiveness
MOFL	Most forward line (same as FLOT)
Mort	Mortar
MPA	Maritime patrol aircraft
MPS	Maritime prepositioned shipping
MR	Medium-range
MRC	Major regional contingency
MRL	Multiple rocket launcher
MRLS	Multiple rocket launcher system
Msl	Missile
Mult	Multiplier
Multi	Multi-role aircraft
MXB	Mechanized brigade
MXD	Mechanized division
NEF	Naval expeditionary force
NM	Nautical miles
NPole	North Pole
Nuc	Nuclear
Nucarty	Nuclear artillery
OAS	Offensive air support
OCA	Offensive counter-air
OIR	Optical infrared
OMG	Operational maneuver group
OOB	Order of battle
Opt	Option
PAA	Primary aircraft authorization
Pac	Pacific
Parameter[N]	Force numbered parameter with index N
PAX	Passengers
Pct	Percent(age)
PED	Platform equivalent divisions
Period	JICM clock advance increment (4 hours)
PK	Probability of kill
Pkg	Package

Place	A JICM geographic point, (e.g. Paris)
PLS	Pre-launch survival
POD	Port of debarkation
POE	Port of embarkation
POL	Petroleum, oil, lubrication
POMCUS	Prepositioned unit sets
Position	An exact location on a JICM link
Prty	Priority
PS	Probability of survival
PSI	Pounds per square inch
QRA	Quick-reaction alert
RAW	Radar and warning
Recce, Reccon	Reconnaissance
Req, Reqd	Required
ROK	Republic of Korea
ROKAF	ROK Air Force (command)
RoRo	Roll-on/roll-off [sealift]
RPG	Rocket-propelled grenade
RRF	Ready reserve fleet
SACEUR	Supreme allied commander, Europe
SAG	Surface action group
SAM	Surface-to-air missile
Sea-bed	one of 5 major ocean areas (in JICM)
Seabox	a unique subset of a JICM sea region
SEAD	Suppression of enemy air defenses
SED	Situational equivalent division
SL-7	A class of fast sealift ship (FSS)
SLBM	Submarine-launched ballistic missile
SLCM	Seal-launched cruise missile
SLOC	Sea line of communication
Sm	Small
SOF	Special operations forces
SOW	Standoff weapon
SP	Self-propelled
Spt	Support
SPOD	Seaport of debarkation
SPOE	Seaport of embarkation
SR	Short-range
SSBN	Subsurface nuclear ballistic [ship]
SSM	Surface-to-surface missile
Std	Standard
Strat	Strategic
StratMob	Strategic mobility
StratNuc	Strategic nuclear
Sub	Submarine, subordinate
Sub-command	Subordinate command
Sub-delta-t	A JICM clock advance increment of less than 4 hours
Sum	Summary
Supp	Supply
Surv	Surviving
TABLE->keyword	A JICM parameter reference

TacNuc	Tactical nuclear
TACSFORM	A weapons evaluation system developed by the Antlytical Science Corporation
TASM	Conventional anti-ship missile
TBM	Theater ballistic missile
TBMD	Theater ballistic missile defense
TD	Towed
TED	Tactical equivalent division
Terr	Terrain
THAAD	Theater high-altitude area defense
TFS	Tactical fighter squadron
TFW	Tactical fighter wing
Tgt	Target
Thtr	Theater
TLAM	Theater land-attack missile
Tng	Training
TO&E, TOE	Table of organization and equipment (authorized equipment list for a force)
TOW	Tube-launched optically tracked, wire-guided (missile)
Trrn	Terrain
Ttl, Tot	Total
UE	Unit equipment
USAF	U.S. Air Force
Use file	A pre-typed file of JICM orders
USMC	U.S. Marine Corps
Ute-rate	Utilization rate (generally hours per day)
VSRBM	Very short range ballistic missile
WB	Side bodied passenger aircraft
Wd	Width
Whd	Warhead
WMD	Weapons of mass destruction
Wpn	Weapon
WRM	War reserve materiel
WSDS	World situation data set
Wx	Weather
Z	Greenwich mean time (zulu time)

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James Ong and Michael F. Ling

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19. ABSTRACT

This report is a review of the Joint Integrated Contingency Model (JICM), which is a large modelling and simulation tool for campaign analysis at the theatre and operational levels. The JICM has been evaluated with special emphasis on its suitability for application in support of the Australian Defence Force. The core of this report is a user's manual, which can serve as a concise guide to new JICM users. It also contains insights gained by the authors into the operation of the JICM.

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